CONFIRMED MINUTES

IHRA SIDE IMPACT WORKING GROUP

10th MEETING

DoTRS, CANBERRA, AUSTRALIA

11-12 DECEMBER 2000

1. ATTENDEES

Keith Seyer	(Chair)	Department of Transport & Regional Services, Australia
Craig Newland	(Secretary)	Department of Transport & Regional Services, Australia
Dainius Dalmotas		Transport Canada
Suzanne Tylko		Transport Canada
Richard Lowne		EEVC
Joseph Kanianthra		National Highway Traffic Safety Administration, USA
Risa Scherer		OICA North America / AAM (proxy for Michael Leigh)
Takahiko Uchimura		OICA Asia Pacific / JASIC / JAMA
Takeshi Harigae		JASIC / JARI
Minoru Sakurai		JASIC / JARI
Hideki Yonezawa		JMoT
Michiel van Ratingen		TNO (observer)
Ming Loo		Ford Australia (presenting data)
Brain Fildes		MUARC (presenting data)
Tom Gibson		Human Impact Engineering (presenting data)

APOLOGIES

Rainer Justen (OICA Europe) and Michael Leigh (OICA North America) both apologised for their inability to attend. Risa Scherer attended on behalf of Mr Leigh to represent OICA North America.

2. MODIFICATIONS TO AGENDA

A revised draft agenda was distributed at the meeting. This was further modified to postpone two items until a later meeting/s – Item 6.1 Comparison of Australian vehicle fleet data and types of vehicles involved in crashes and Item 8.2 US analysis of struck vehicle velocity on injury outcome. Mr Dalmotas also requested that Item 6.1 include an analysis of the age and gender of fatally injured occupants.

Several items were added to the agenda:

Item 8.4 Presentation of Transport Canada test data.

Item 8.5 JMOT presentation.

Item 8.6 JAMA presentation

Item 8.7 EEVC load cell wall data

Item 8.8 EEVC ECE R95 barrier specification update.

Item 8.9 Results from EEVC tests using modified (wide) barrier face.

Item 8.10 Discussion of the IIHS Side Impact tests using a modified barrier design.

A presentation by Brian Fildes and Tom Gibson was included under Item 11 (Other business).

The modified agenda has Document Number SIWG 114 Rev2.

3. MINUTES OF THE PREVIOUS MEETING

The draft minutes of the ninth meeting, held in Lyon were amended, approved and confirmed. The confirmed minutes have document number SIWG 113 Rev 2.

4. REPORT FROM WORLDSID TASK GROUP

Mr Uchimura delivered an update on the activities of the WorldSID Task Group. The update was brief as all members except Mr Yonezawa attended the WorldSID workshop in Melbourne held last week. The dummy had been demonstrated and discussed at the workshop, with a Task Group meeting held immediately after the workshop.
As part of the workshop, on December 1 a crash test using ECE R95 test conditions was conducted.
On December 8 a vehicle to vehicle side impact crash test was conducted with a stationary Ford Falcon AU2 impacted by a Landrover Freelander. Unfortunately, data was not obtained for the WorldSID dummy's right (struck) leg, rib deflections and rib accelerations.

Mr Uchimura noted that the price of WorldSID dummies was not yet fixed. An undertaking has been given to purchase a minimum of 6 dummies. This is to be discussed further at the Tri-Chair meeting in Europe.

Testing and evaluation of the dummy by Transport Canada and NHTSA is scheduled to commence in January 2001.
In mid April a Task Group meeting will be held in Japan to review the TC/NHTSA tests for presentation at the ESV conference.

A family of WorldSID dummies has been discussed, but no decisions have yet been taken. The WorldSID Task Group is requesting direction on this matter from the IHRA Side Impact and Biomechanics Working Groups.

5. REPORT FROM IHRA BIOMECHANICS WORKING GROUP

The IHRA Biomechanics Working Group (BWG) met in May 2000 (Washington) and November 2000 (Atlanta).
The report to the IHRA Steering Committee includes 4 draft sections – Anthropometry (drafted by Mr Seyer – Australia), Definition of the Global Side Impact Injury Problem (Mr Dalmotas – Transport Canada), Side Impact Dummy Response Requirements (mostly by Mr Maltese - NHTSA) and Injury Criteria (Mr Cesari – INRETS).
The BWG requires at least 2 more meetings to finalise the report. The next meeting is scheduled for Lyon, France 29-30 January 2001.
Mr Kanianthra asked whether the injury criteria are intended only for an adult male. The injury corridors are currently scaled for a 50th percentile adult male, but could be recalculated for other dummy sizes.
It was noted that the WorldSID prototype has been designed to meet ISO TR9790 (because the IHRA BWG requirements were not available), but that the production release WorldSID should meet IHRA BWG requirements.

Mr Lowne stated that there are 2 possible philosophies when defining injury criteria:
1. Match cadaveric responses and use cadaveric data to set the injury limits.
2. Manufacture a dummy and set the injury limits based on dummy response.

He questioned which one of these would be used for the WorldSID. There was no definitive answer to this question, but the 2nd method was assumed.

6. PRESENTATION OF ACCIDENT STUDIES

(Nil).

7. GEOMETRIC STUDIES OF THE FLEET

(Nil).

8. TEST RESULTS AND TEST MATRICES

8.1 Ford redesign of AU Falcon for ECE R95 [Ming Loo – Ford Australia]

Ming Loo presented detailed information on the modifications to the Ford AU Falcon for ECE R95 compliance (Document Number SIWG 115).
The previous model of this vehicle (1994 EF/EL Falcon) was tested and found to comply with the requirements of FMVSS 214 (dynamic). The AU Falcon, released in 1997 (1998 model year) was also tested and met FMVSS 214 (values within 60%-70% of the regulatory limits). In the second quarter of 1999, Ford embarked on a project to redesign the AU Falcon to meet ECE R95, without the need for a side airbag.
The AU Falcon was tested to ECE R95. Vehicle mass 1732kg. Cellbond Multi 2000 version 15 deformable barrier face. The results obtained showed that the VC results on all ribs were beyond the ECE R95 injury limits, as were the deflections on the two upper ribs. The abdominal and pubic symphysis forces were below the ECE R95 injury threshold.

A plastic hinge was noted to have formed at the belt line in the B-Pillar. Low retention of the B-Pillar at the base and an inverted B-Pillar were also evident from this test. Ming commented that door velocity is influenced by the B-Pillar. The B-Pillar velocity at the belt line was around 11 m/s, with the dummy pelvis contact leading that of the dummy thorax. The difficulty of dealing with rotation of the accelerometers on the deforming structure was mentioned.

This crash was modelled using FE (140,000 element model – 130,000 vehicle, 5500 EuroSID-1, 4500 MDB). The model was used to investigate and predict appropriate design solutions.
Stresses above the belt line in the B-Pillar were reduced by allowing the B-Pillar to pivot at the roof. The gauge and yield strength of the material used in parts of the B-Pillar were increased to prevent formation of the plastic hinge. Discontinuities in B-Pillar reinforcements were also eliminated and 2 additional reinforcements incorporated in the design. The model predicted a reduction in B-Pillar beltline velocity to 8m/s or less. The target intrusion profile for the door aimed to sequentially strike the dummy pelvis, thorax and abdomen. The AU2 Falcon (modified as per the predictive FE model) was tested to ECE R95 with the much improved results in the thorax. Rib deflections were all less than 65% of the ECE R95 limits and VC values were all less then 0.3. Abdominal and pubic symphysis forces were not significantly changed and continues to meet ECE R95 requirements.

Ming commented that since the armrest area of the door was unchanged, it was not surprising that the abdominal force had not changed significantly from the AU Falcon. A pelvic foam has also been added for the AU2, which may be too stiff, as the pelvic acceleration had not been attenuated much.
The FE model predicts that the loads in the B-Pillar start at the beltline, migrate down to the rocker (sill) and then after rocker deformation the loads move up into the roof. The simulation also predicts that the AU2 will continue to comply with FMVSS 214.

8.2 US analysis of struck vehicle velocity on injury outcome [NHTSA]

Item postponed until a later meeting.

8.3 DoTRS/TC parametric study – supplementary test to examine effect of bullet mass (Australia)

Mr Newland advised that there was an error in document SIWG 109 presented at the meeting in Lyon. The VC values had not been correctly calculated. Corrected values were presented and will be distributed in a revised version of this document [SIWG 109 Rev 2]. Mr Newland pointed out that the original conclusions are still valid and remain unchanged.

8.4 Transport Canada test results (Transport Canada)

Mr Dalmotas presented a Progress Report on TC Side Impact Research (Document SIWG 116). Vehicle crash tests were conducted using SIDIIs dummies. A Q3 dummy was used in the rear seating position if rear seat side airbags were

fitted. The aim of the tests was to assess head protection for passenger car occupants in LTV to car side impact collisions.

Mr Dalmotas commented that high thoracic injury values were recorded on the SIDIIs. He also noted that head injuries are rare in car to car crashes, however, LTV to car crashes have a high frequency of head injury due to contact with the hood. Test results show HIC values of around 2000, with accelerations of 280g. Some tests had also shown that head protection for the 5th percentile female had not been taken into consideration, as the head does not align with the deployed protection system. A redesign of such systems was necessary.

Tests using an MDB with a widened ECE R95 barrier increased the driver and rear passenger responses to that comparable with vehicle to vehicle tests. Crabbing was shown to reduce the loading on the driver, but increase the load on the rear passenger. A comparison of deformed vehicle intrusion profiles showed that the widened ECE R95 barrier provides an accurate representation of a car to car crash at the mid door location.

A test in which a Ford Explorer impacted a Windstar (with side airbag) at 50°, 45 km/h resulted in SIDIIs thoracic rib deflection of 52mm and abdominal rib deflection of 70mm. By comparison, a Camry to Camry (with side airbag) perpendicular test at 50 km/h resulted in SIDIIs thorax deflection of 34mm, with slightly higher values recorded in the abdomen. Mr Dalmotas said that the presence of a side airbag resulted in an even distribution of load on the thorax and generally reduced abdominal deflections. With no side airbag, thorax deflections can be lower, however, abdominal deflections are usually higher.

Transport Canada are also conducting tests using the IIHS modified (contoured) 1500kg moving deformable barrier, which is designed to represent an LTV. Non-crabbed 50 km/h tests were planned, with 54 km/h crabbed tests to be conducted only if a head strike was achieved in the non-crabbed test.
The first test using a Toyota Camry (perpendicular impact 50km/h) using a SIDIIs driver resulted in a HIC of 2008, 285g head acceleration, 35mm thoracic rib deflection and 68mm abdominal deflection. The SIDIIs rear passenger recorded a peak abdominal deflection of 40mm.

8.5 JMOT testing

Mr Yonezawa presented the results of side impact tests conducted by JMOT (Document SIWG 117). A series of 10 tests were conducted using 2 passenger cars. Two of the ten tests used only one dummy. Both crabbed and non-crabbed configurations were evaluated. Eight tests used only struck side ES-2 dummies; two tests used struck and non-struck dummies, either EuroSID or ES-2.
The tests showed that crabbing reduces the driver responses for both vehicles A and B. The rear dummy responses (HPC, thoracic and abdominal rib deflections) increased with crab angle, however, a similar increase in pubic force was not observed.

The results for ES-2 and EuroSID were similar, however, the ES-2 showed a reduction in flat-topping and a reduction in the second peak in the pubic force response.

Non-struck side dummy results were much lower than struck side dummy responses.
Tests to investigate the effect on dummy responses of the MDB configuration are being planned.

The JMOT stance favours a non-crabbed barrier. Tests using both a crabbed and non-crabbed FMVSS 214 barrier showed higher loads on the driver in the non-crabbed configuration.

Tests had also been conducted using SIDIIs, however, the rib deflection data was noisy, with consequent noise in the VC. One rib was found to be damaged and the LVDT was bent.

8.6 JAMA testing

Mr Uchimura presented the results from tests conducted by JAMA (Document SIWG 118) to evaluate ES-2. The tests compared EuroSID with ES-2.

The test vehicle was a small 1200kg MPV with a high seating reference position and fitted with a side airbag. This vehicle was impacted at 55 km/h by a 950kg ECE R95 MDB (300mm ground clearance for the barrier face). This test was conducted using EuroSID and repeated using ES-2, with the primary purpose to evaluate ES-2.

The ES-2 HPC, Abdominal Peak Force and Pubic Symphysis Peak Force were lower than for EuroSID in the same test, however, rib deflections and VC were higher. The second peak in the pubic force response is significantly reduced for the ES-2, although still present with the same timing as observed on the EuroSID. The ES-2 clearly showed loading through the back plate, but this is not measured on EuroSID. The ES-2 T-12 data is higher than that for EuroSID and coincides with the timing of the back plate loads recorded on ES-2.
Mr Uchimura noted that the T-12 acceleration-time histories are the same for EuroSID and ES-2 when there are no back plate loads on ES-2.

The rib responses on the EuroSID were shown to persist for around 80ms, whereas the ES-2 response diminishes at around 50ms.
There also appeared to be some strange rib acceleration results on ES-2 after 30-40ms.

JAMA recommends further analysis of existing data as a result of ES-2 testing.

8.7 EEVC Load Cell wall data

Mr Lowne presented information and initiated a discussion on the initial stiffness of vehicle front structures. The presented information has document number SIWG 119.

Barrier force contour plots and maximum force plots were presented for both the Renault Megane and Ford Mondeo.

Mr Lowne pointed out that nobody has run any tests to investigate the effect of initial stiffness of vehicle front structures on the struck vehicle. Mr Seyer said he would raise this issue with the IHRA Compatibility Working Group.
Transport Canada offered to conduct a test using 75mm thick 20 psi honeycomb on the front of a bullet vehicle and compare with a previous result to evaluate this effect.
It was also mentioned that Ken Digges was currently analysing NHTSA Load Cell Wall data to look at this issue.

Mr Lowne questioned whether it would be better to design a deformable barrier face with constant stiffness or a stiffness that increased with crush.

Mr Dalmotas stated that the geometry should first be defined and then stiffness considered. He noted that it may be possible to use a contoured barrier that is homogeneous to achieve the desired result. He suggested that it would be better to err on the side of being over-stiff rather than too soft.
Mr Lowne was concerned that this would not replicate the dimple of a B-Pillar in the barrier/striking vehicle and there would be no “punch through” effect.
Mr Dalmotas replied that it may be possible to achieve the B-Pillar dimple with 45psi honeycomb. Transport Canada has also conducted tests impacting Camry, SAAB and BMW with a non-crabbed Ford Explorer, which shows a B-Pillar dimple.

8.8 ECE R95 Barrier Specification

Mr Lowne presented an update on the EEVC specification for the deformable barrier face to be used for side impact testing (Document SIWG 120).
The new specification to be recommended by the EEVC will be design prescriptive rather than performance based. A “Progressive” barrier face with adhesive, material type and thickness will be specified. A quasi-static and dynamic force-deflection response for each block will be required. The EEVC expect to be able to tighten the corridors now that the design is specified. The EEVC will conduct a number of evaluation tests, testing all candidate barrier types against a flat load cell wall, as well as some of the other EEVC barrier evaluation tests (eg angled wall and pole test). Japan and AAM have been invited to participate in this activity.
GRSP will vote on the new barrier specification in December 2001.
EuroNCAP are also keen to use the new barrier face after recommendation by EEVC.

8.9 EEVC tests using widened ECE R95 barrier

Mr Lowne recapped the work done by the EEVC using modified ECE R95 barrier faces.

8.10 IIHS Side Impact barrier development

Mr Kanianthra raised for discussion the work being done by IIHS in developing a new barrier face, designed to represent an LTV. The barrier face is manufactured from 45psi aluminium honeycomb and is contoured. The MDB trolley mass is 2000kg. The IIHS barrier face has 100mm greater ground clearance than the FMVSS214 barrier face and has an overall height that is 300mm higher from the ground.
Most IHRA SIWG members were already aware of this work. Mr Newland informed the group that IIHS had been invited to present this study to IHRA, but had declined to do so at this meeting as insufficient testing had been conducted at this time.

9. ISSUES TO BE ADDRESSED IN PROPOSED ELEMENTS OF IHRA SIDE IMPACT TEST PROCEDURE

(Nil).

10. DISCUSSION OF IHRA SIDE IMPACT WORKING GROUP ESV REPORT

The comments on the ESV report submitted via email by the Japanese delegation were noted and will be incorporated in the report. A copy of the final ESV paper to be circulated to the group by Mr Newland.

11. OTHER BUSINESS

Professor Brian Fildes (Monash University Accident Research Centre) and Tom Gibson (Human Impact Engineering) presented a summary of work conducted under a collaborative project “Improved Side Impact Protection” (ISIP). These presentations have document numbers SIWG 121 and SIWG 122 respectively.
The ISIP project was initiated in 1997 and aims to develop a vehicle design tool to enable improved side impact protection through crash testing and modelling. It is hoped that this may avoid the shortcoming associated with assessing side impact protection via a single crash test.
Brian Fildes stated that there were around 77000 side impact injuries annually in Australia. He also presented a break down of the statistics of side impact injury in Australia.
Tom Gibson discussed the development of injury assessment criteria in the ISIP project.

12. NEXT MEETING

The next meeting will be on Monday 05 March 2001 (all day) and Tuesday 06 March 2001 (morning only) in Geneva, Switzerland.

13. MEETING CLOSED.

CRAIG NEWLAND

14 June 2001